

# MTSAT

Integrated CNS Conference & Workshop

20 May 2003

Annapolis

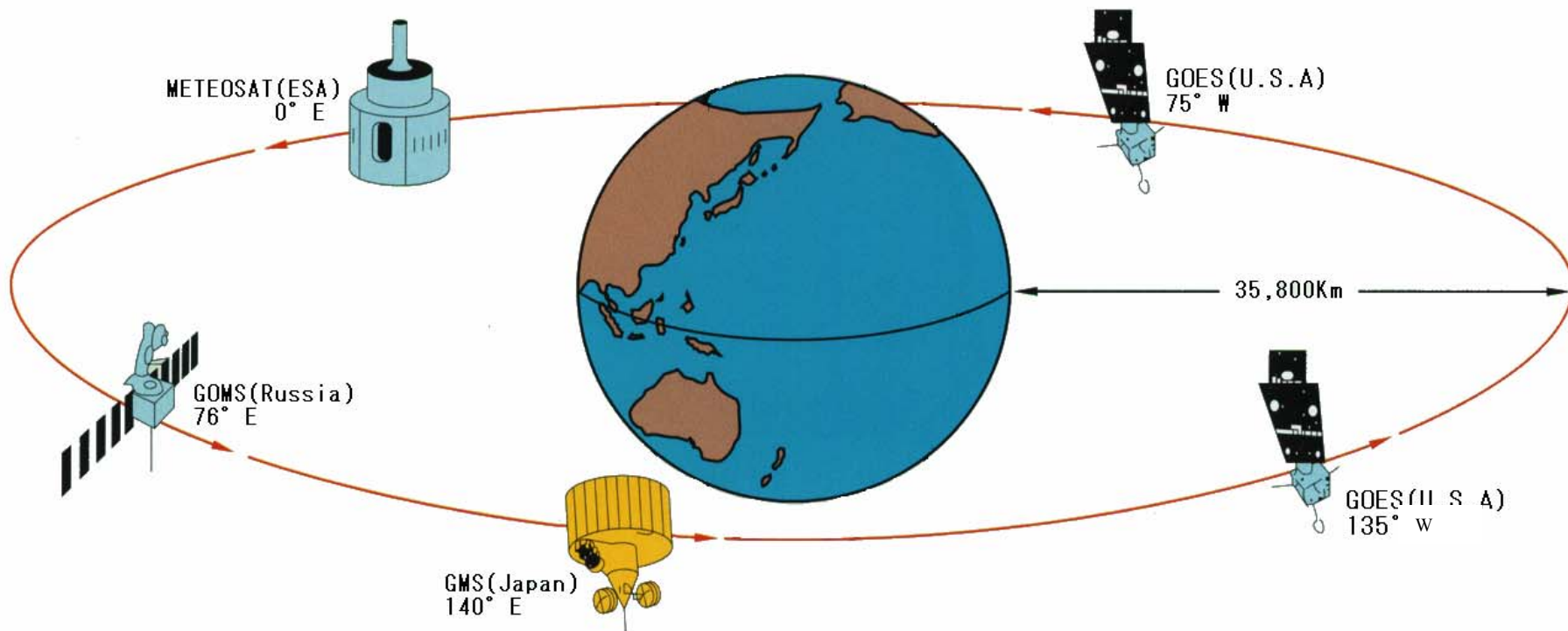
Shigeki Masuda

Civil Aviation Bureau Japan

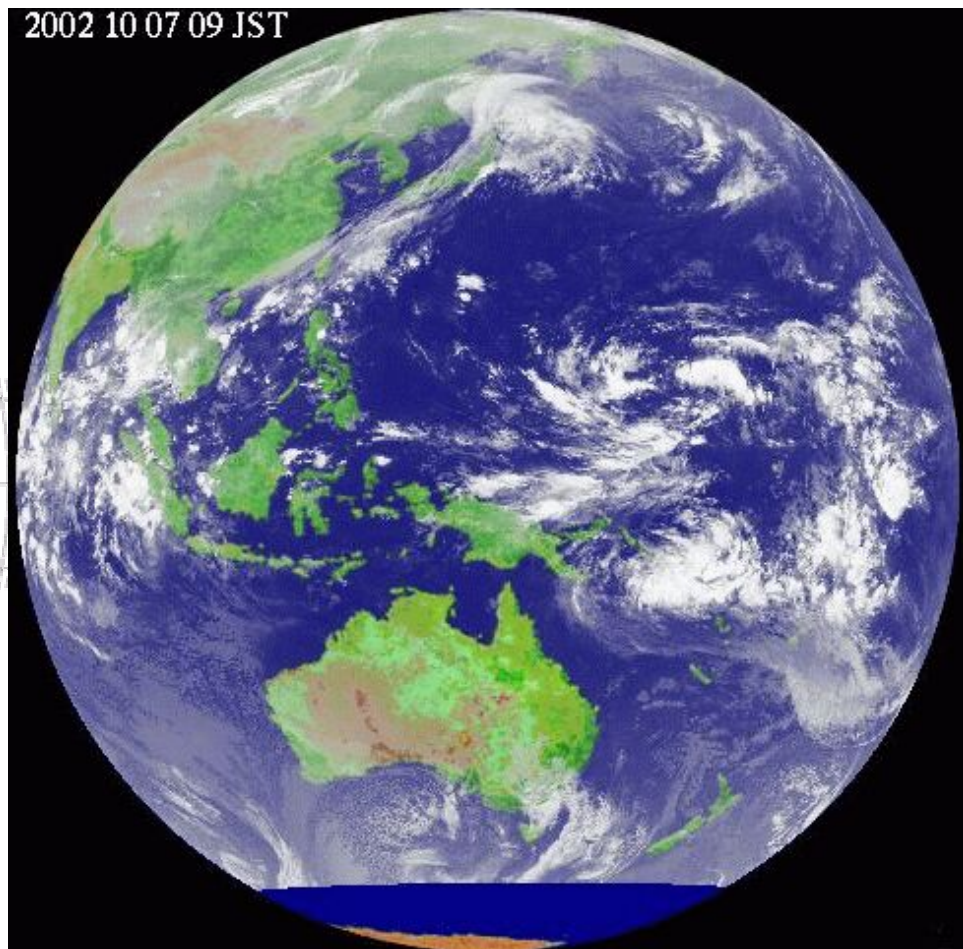
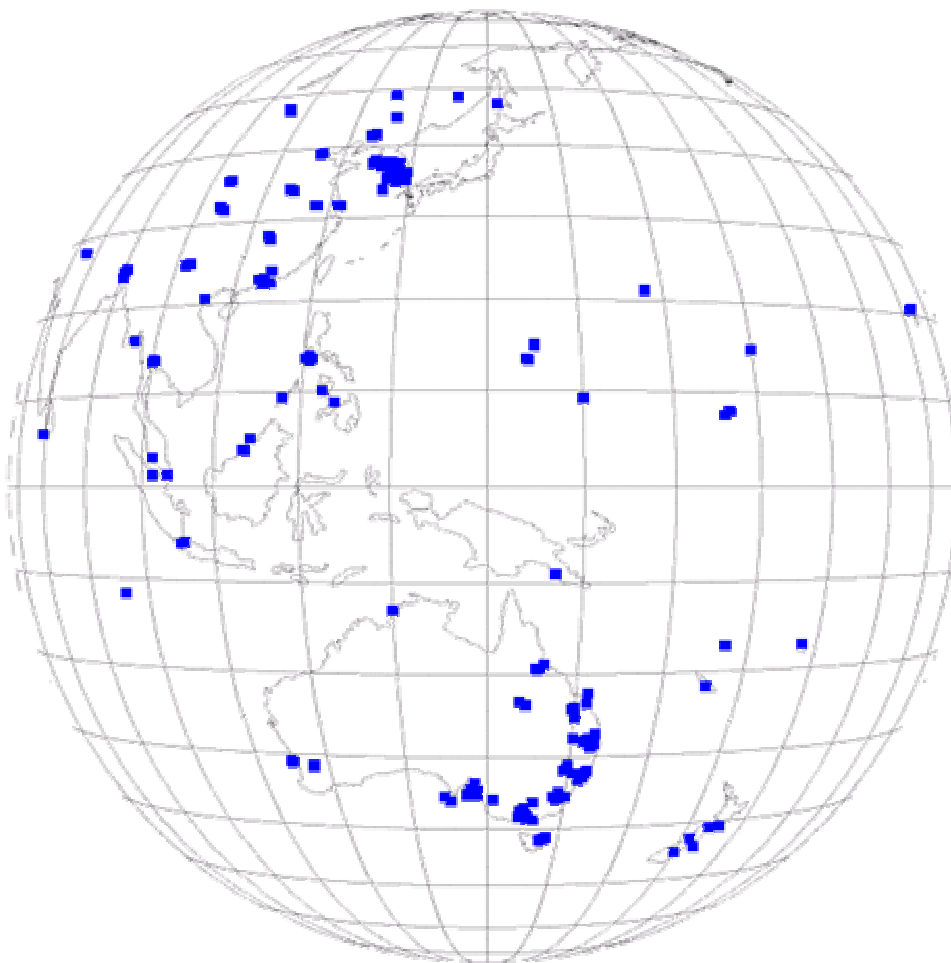
# Mission of MTSAT

- **Twofold; Aeronautical and Meteorological, two payloads onboard that work independently.**
- **“MTSAT” stands for Multi-functional Transport Satellite.**
- **Owner and Operator;**
  - **JCAB (Japan Civil Aviation Bureau) and**
  - **JMA (Japan Meteorological Agency),****both belong to MLIT. (Ministry of Land, Infrastructure and Transport)**
- **Aeronautical mission provides two services. (MSAS & AMSS)**

# World meteorological satellite observation network

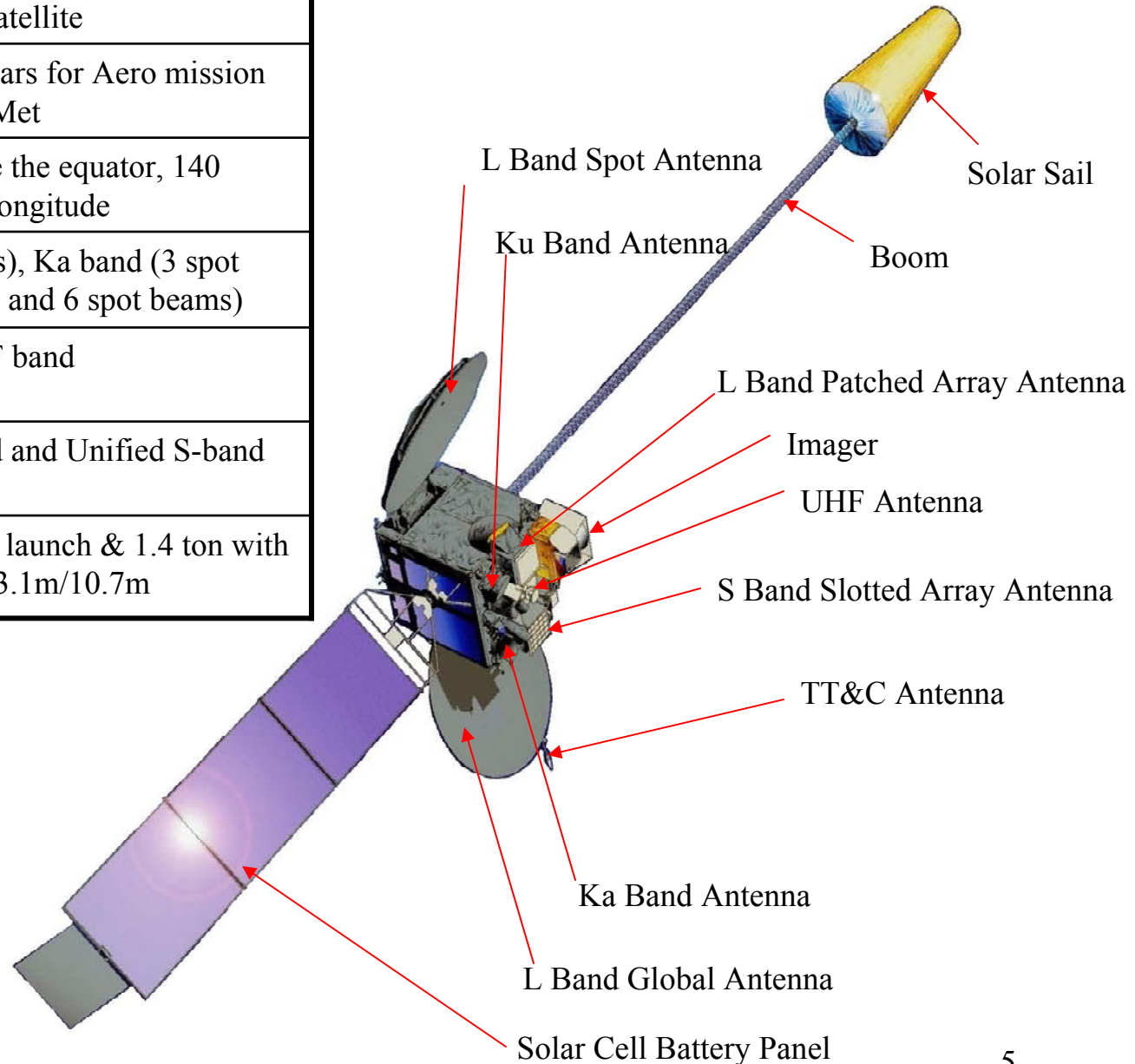


# Distribution of Utilization Station on GMS-5



# MTSAT Specifications

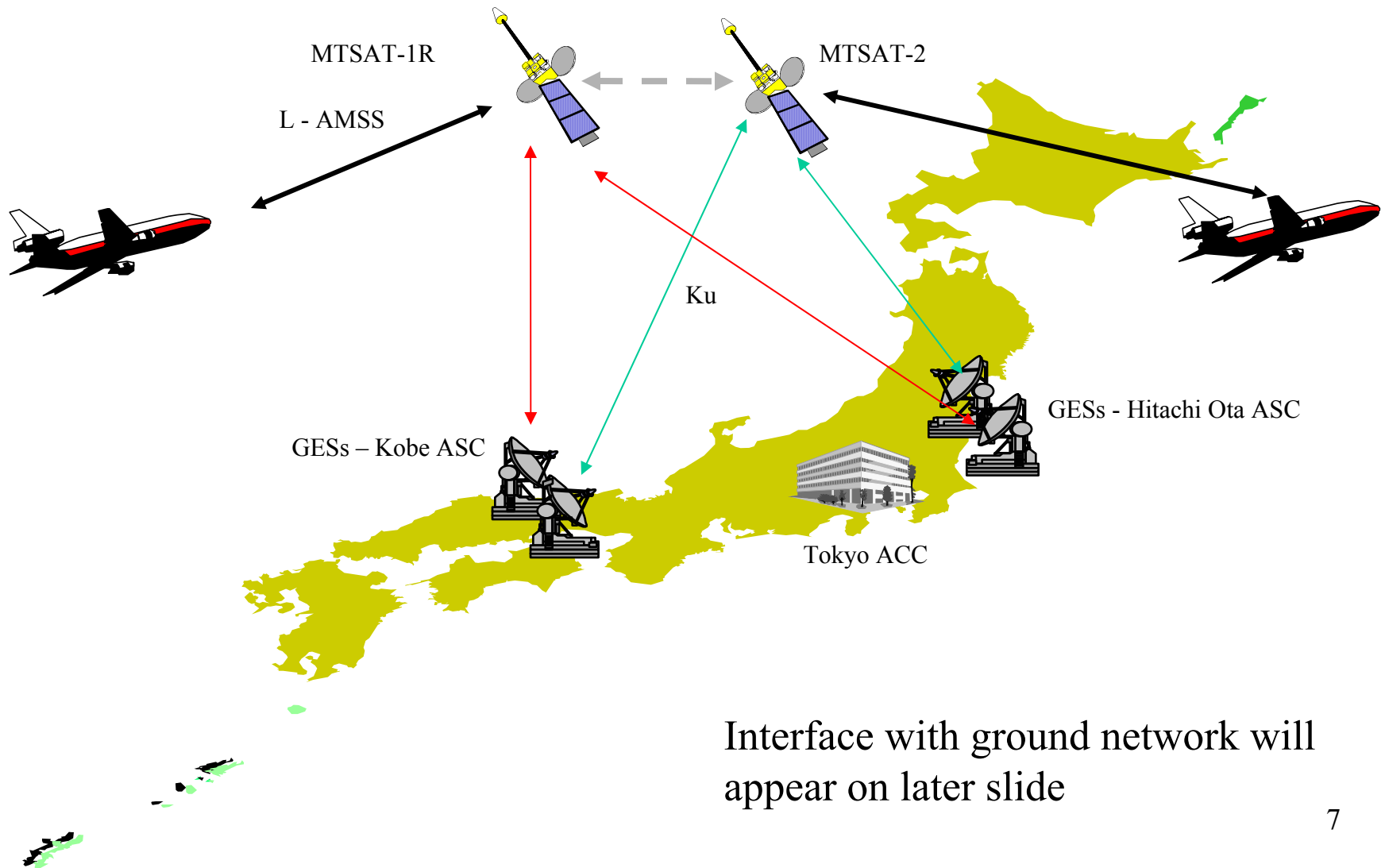
Type	3 Axes Attitude Controlled Geostationary Satellite
Life	More than 10 years for Aero mission and 5 years for Met
Orbit	36,000km above the equator, 140 degrees of east longitude
Frequency for Aero mission	Ku(4 spot beams), Ka band (3 spot beams) L(global and 6 spot beams)
Frequency for Met mission	S band and UHF band
Frequency for TT&C	Ku band, S band and Unified S-band
Weight /Length/Width	About 3.3 ton at launch & 1.4 ton with dry condition /33.1m/10.7m



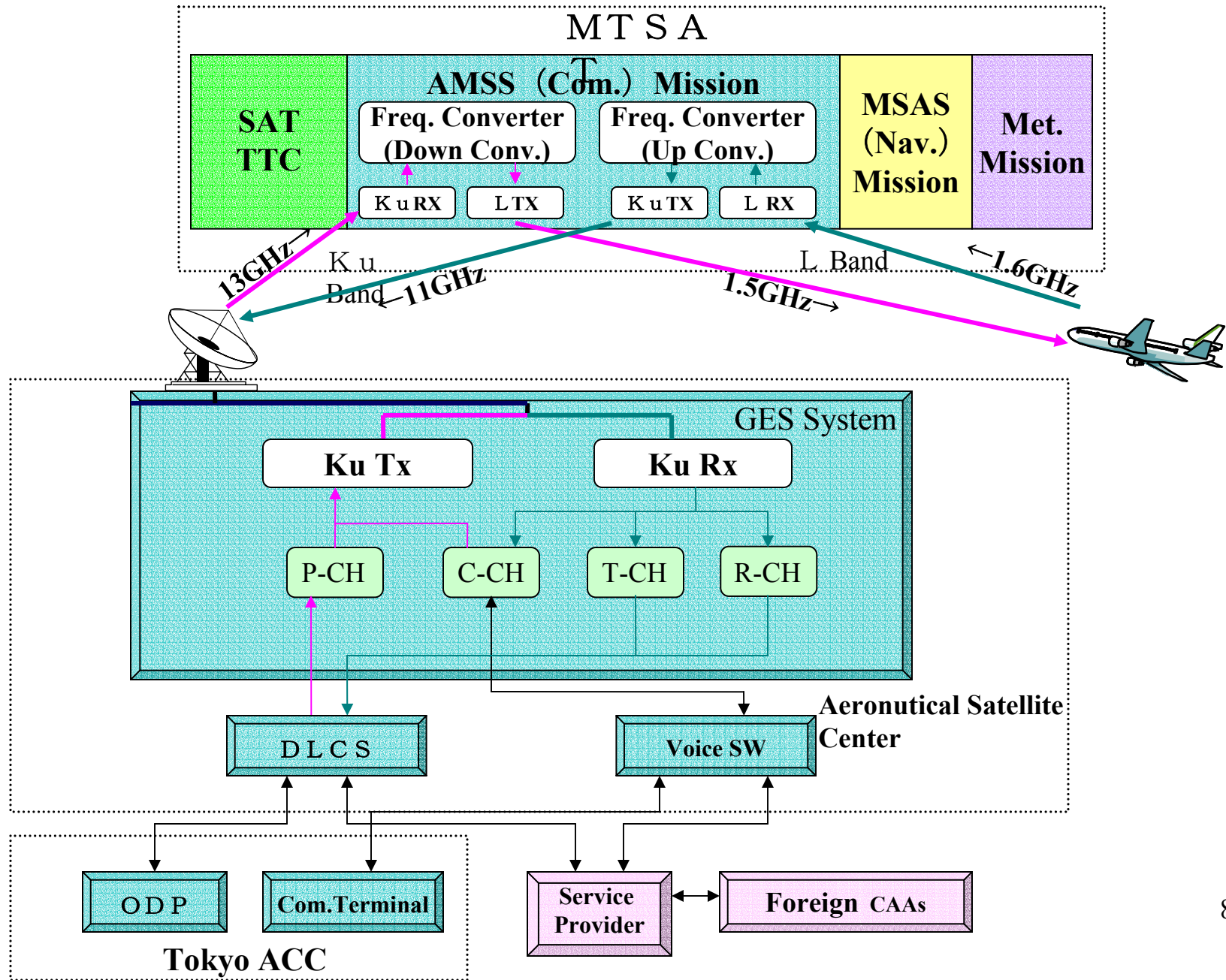
# MTSAT Aero Mission Objectives

- **Provide safe and efficient aircraft operation in the growing Asia/Pacific airspace, based on ICAO New CNS/ATM Concept, utilizing AMSS and MSAS**
- **Core two MTSATs on the orbit and four GESs at two Aeronautical Satellite Centers.**

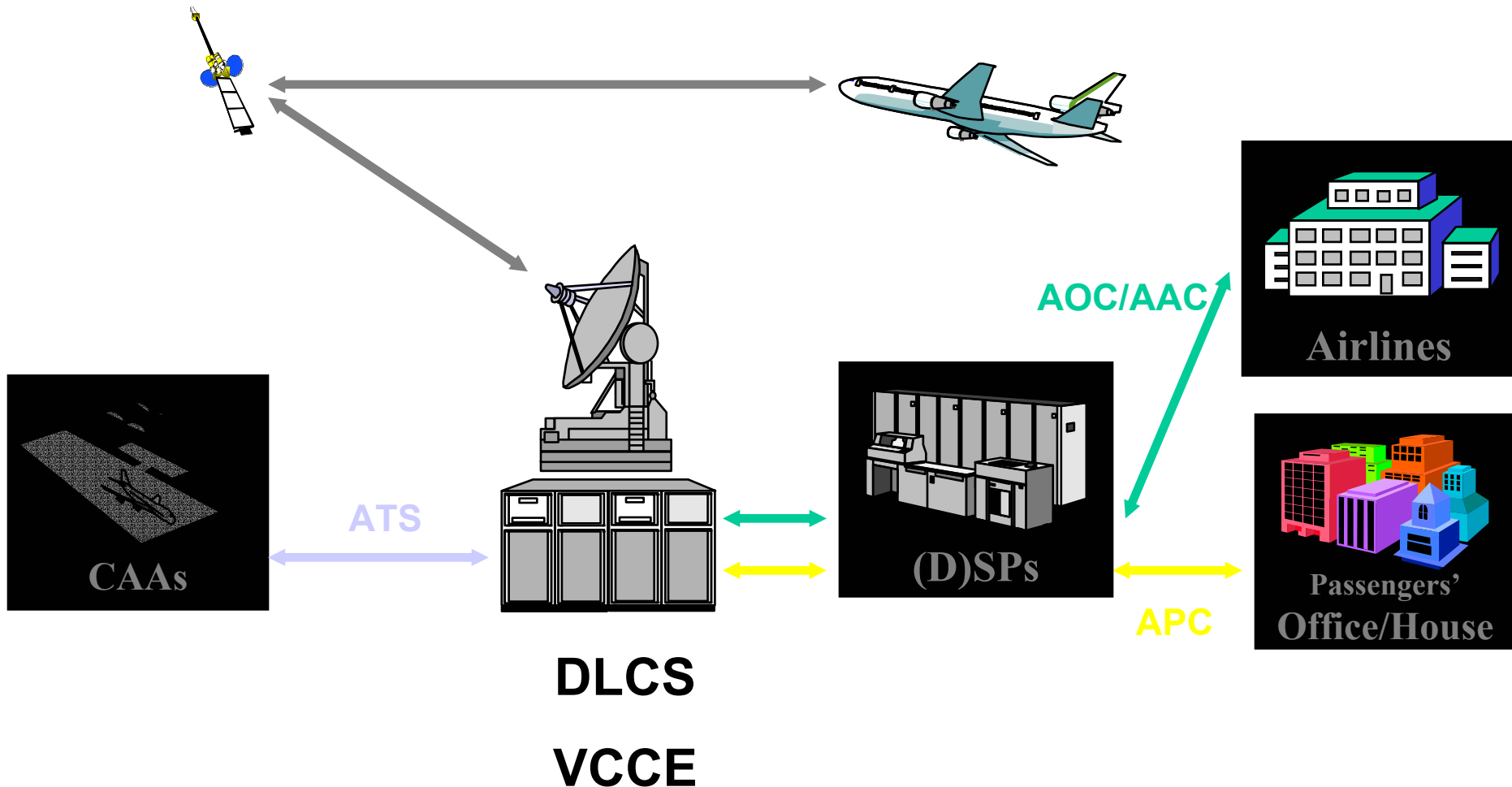
# System Configuration - AMSS



# AMSS Configuration



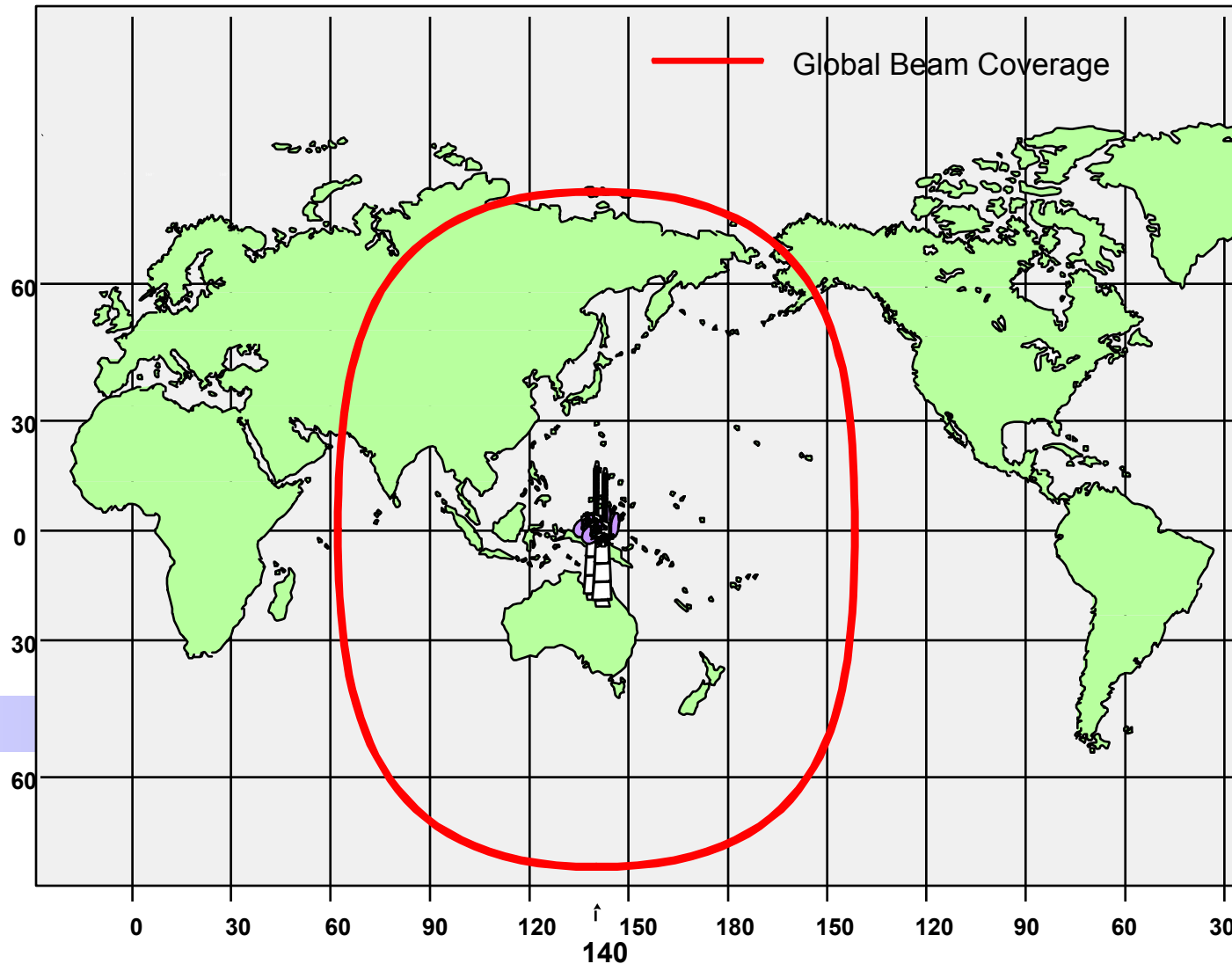
# Interface with ground network



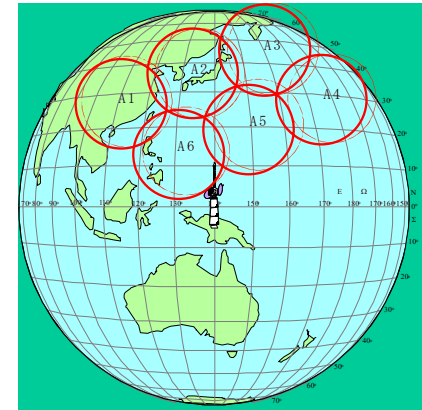
# Channel Specification

Channel	Meanings	Direction	Channel Rates	Modulation Type	Bandwidth/ch
<b>P</b>	Packet mode-time division multiplex (TDM) channel	Forward Link	600 / 1200 bps	1/2 FEC A-BPSK	5.0 KHz
			10.5 kbps	1/2 FEC A-QPSK	10.0 KHz
<b>R</b>	Random access (slotted Aloha) channel	Return Link	600 / 1200 bps	1/2 FEC A-BPSK	2.5 KHz
			10.5 kbps	1/2 FEC A-QPSK	10.0 KHz
<b>T</b>	Reservation-time division multiple access (TDMA) channel	Return Link	600 / 1200 bps	1/2 FEC A-BPSK	2.5 KHz
			10.5 kbps	1/2 FEC A-QPSK	10.0 KHz
<b>C<sub>H</sub> Service</b>	Circuit mode-single channel per carrier (SCPC) channel---Full Rate	Forward Link	21.0 kbps	1/2 FEC A-QPSK	17.5 KHz
		Return Link	21.0 kbps	1/2 FEC A-QPSK	17.5 KHz
<b>C<sub>I</sub> Service</b>	Circuit mode-single channel per carrier (SCPC) channel---Half Rate	Forward Link	8.4 kbps	2/3 FEC A-QPSK	7.5 KHz
		Return Link	8.4 kbps	2/3 FEC A-QPSK	7.5 KHz

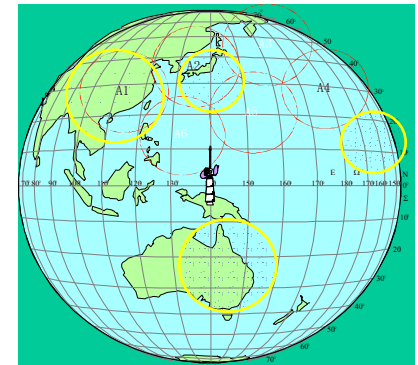
# Beam Coverage-Global and Spot



Six Spot Beams to cover Japan's FIR



Feeder Link (Ku-Band)



# Redundant Configuration

## **Satellites**

**Both MTSAT-1R and MTSAT-2 will be operated simultaneously, sharing the same traffic volume with each other.**

**The communication link will be switched over to another MTSAT Satellite instantaneously in the case of a malfunction of a MTSAT satellite to ensure continuous AMSS.**

## **GESs**

**Geographically separated Aeronautical Satellite Centers are located in two sites, Kobe and Hitachi Ota.**

**Each ASC consists of two dedicated GESs for MTSAT-1R and MTSAT-2, which also has the capability to switch over to another GES when any anomaly arises.**

# Kobe Aeronautical Satellite Center



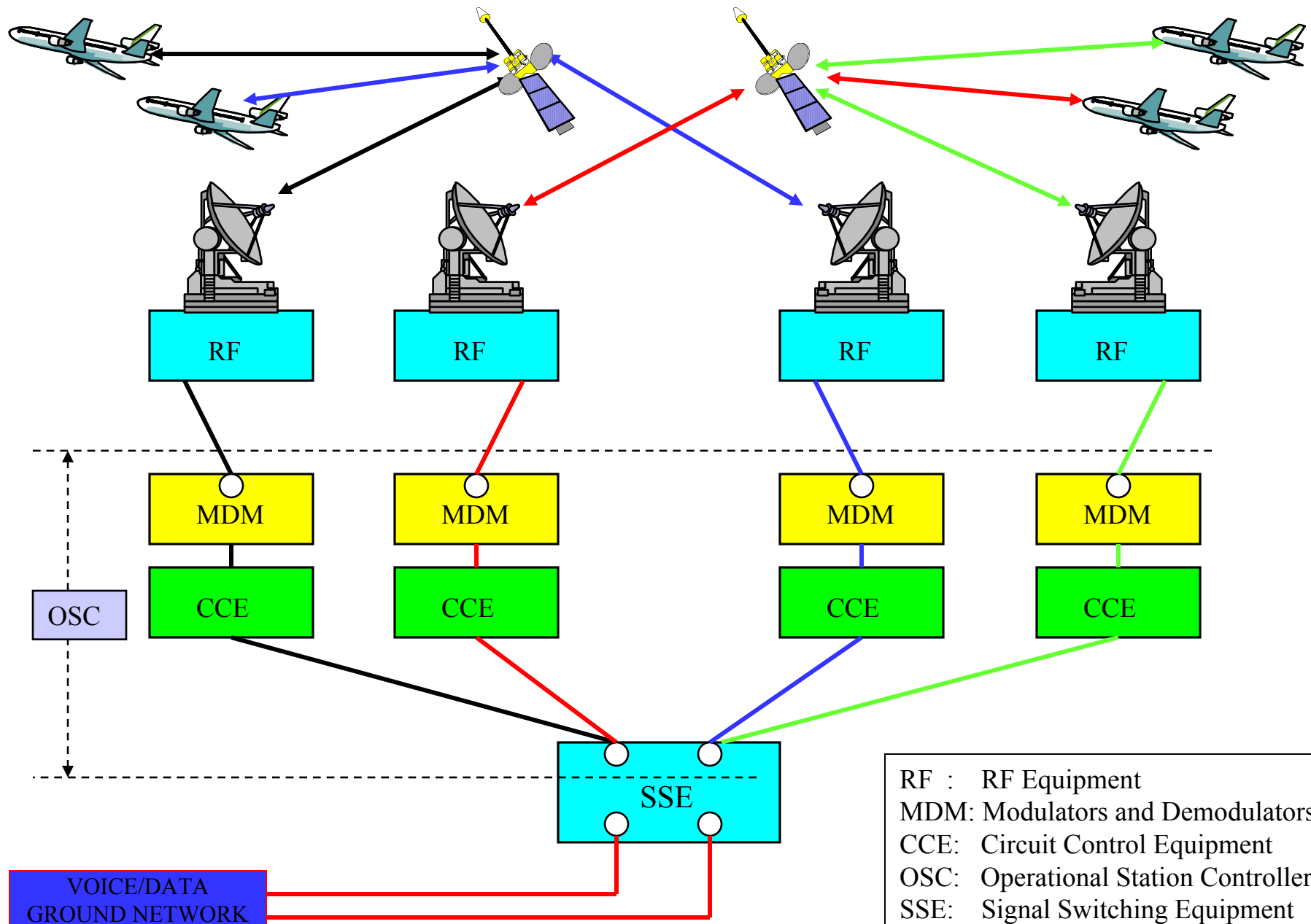
# Hitachiota Aeronautical Satellite Center

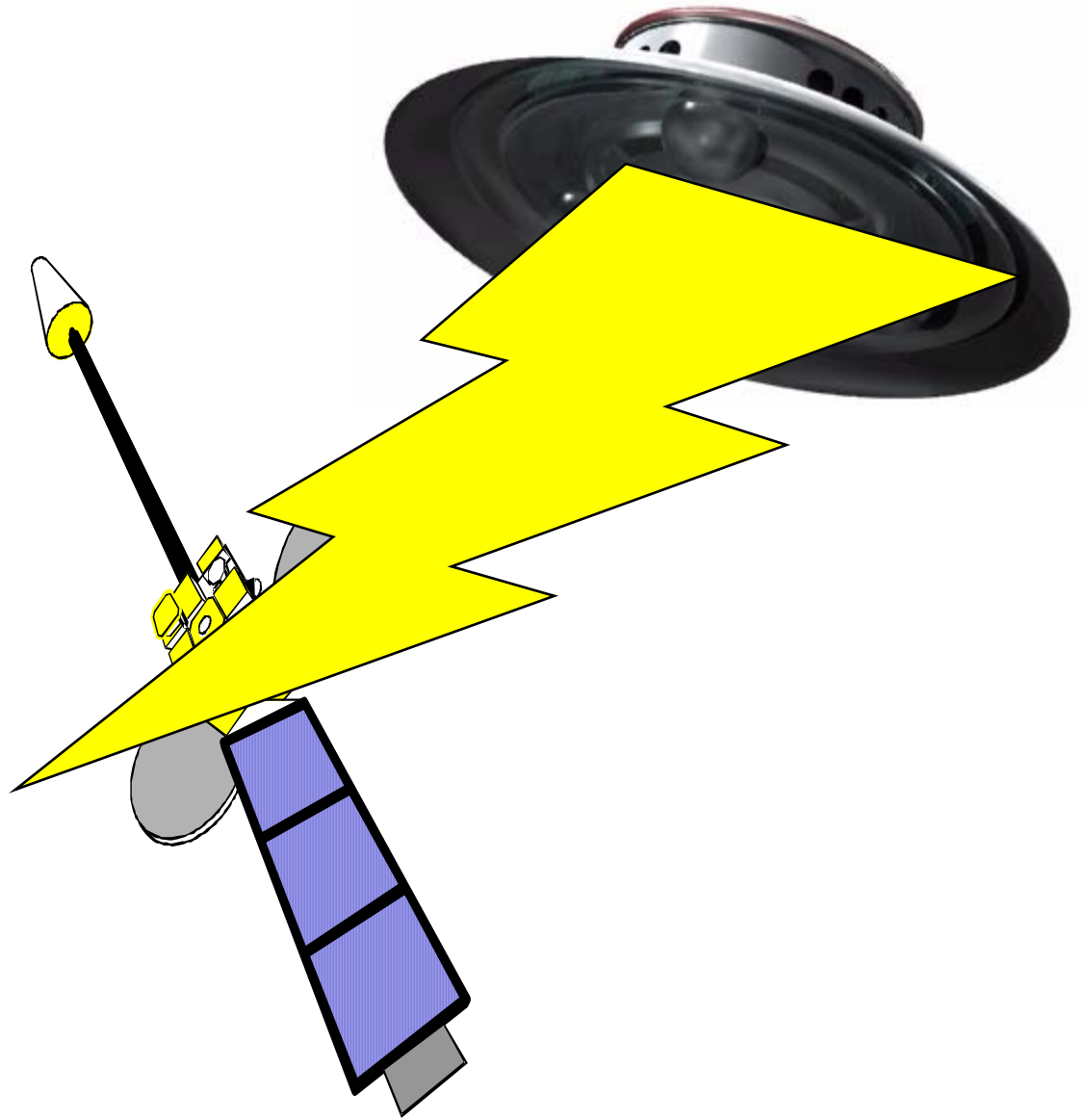


# Satellite Operation Room

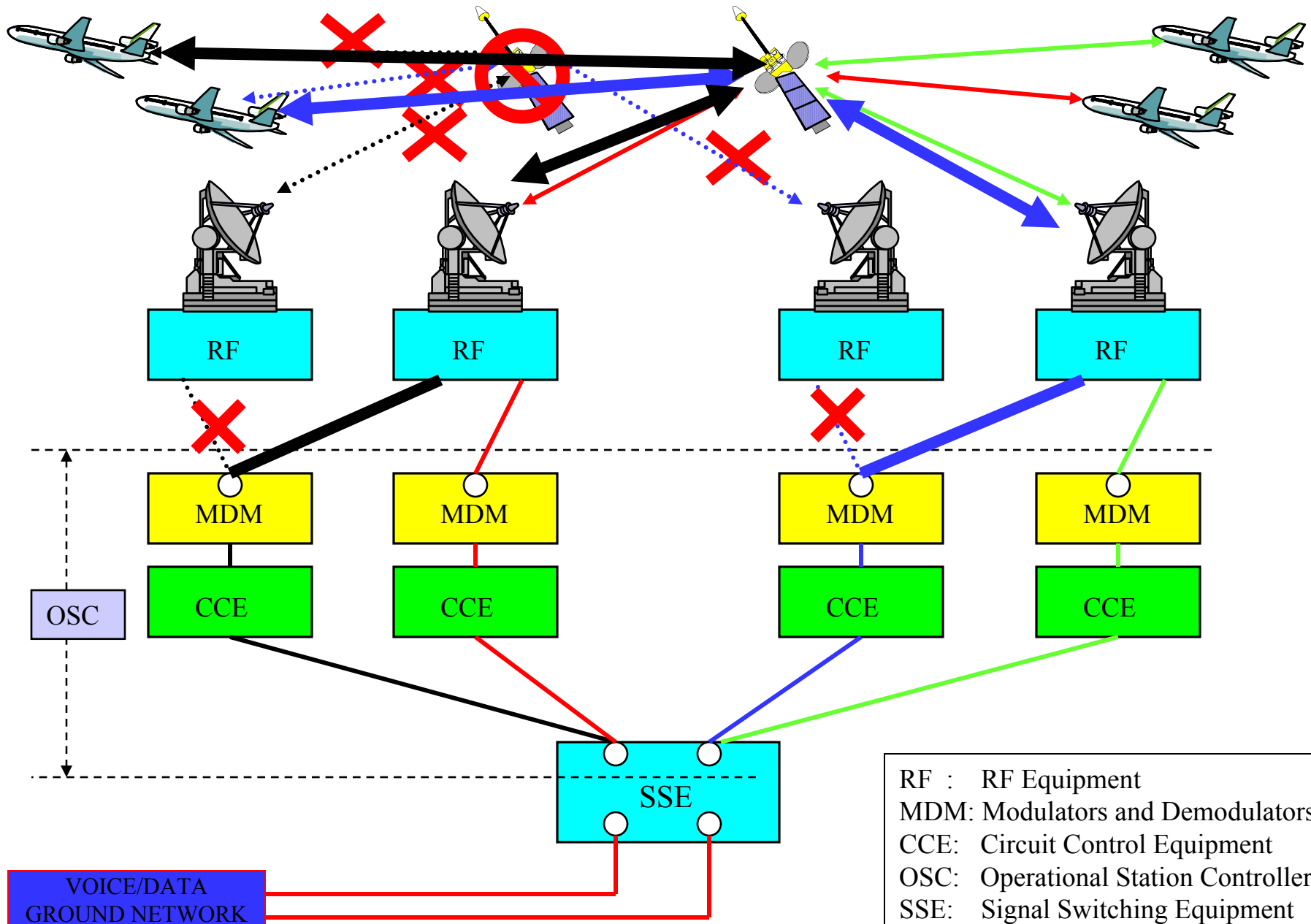


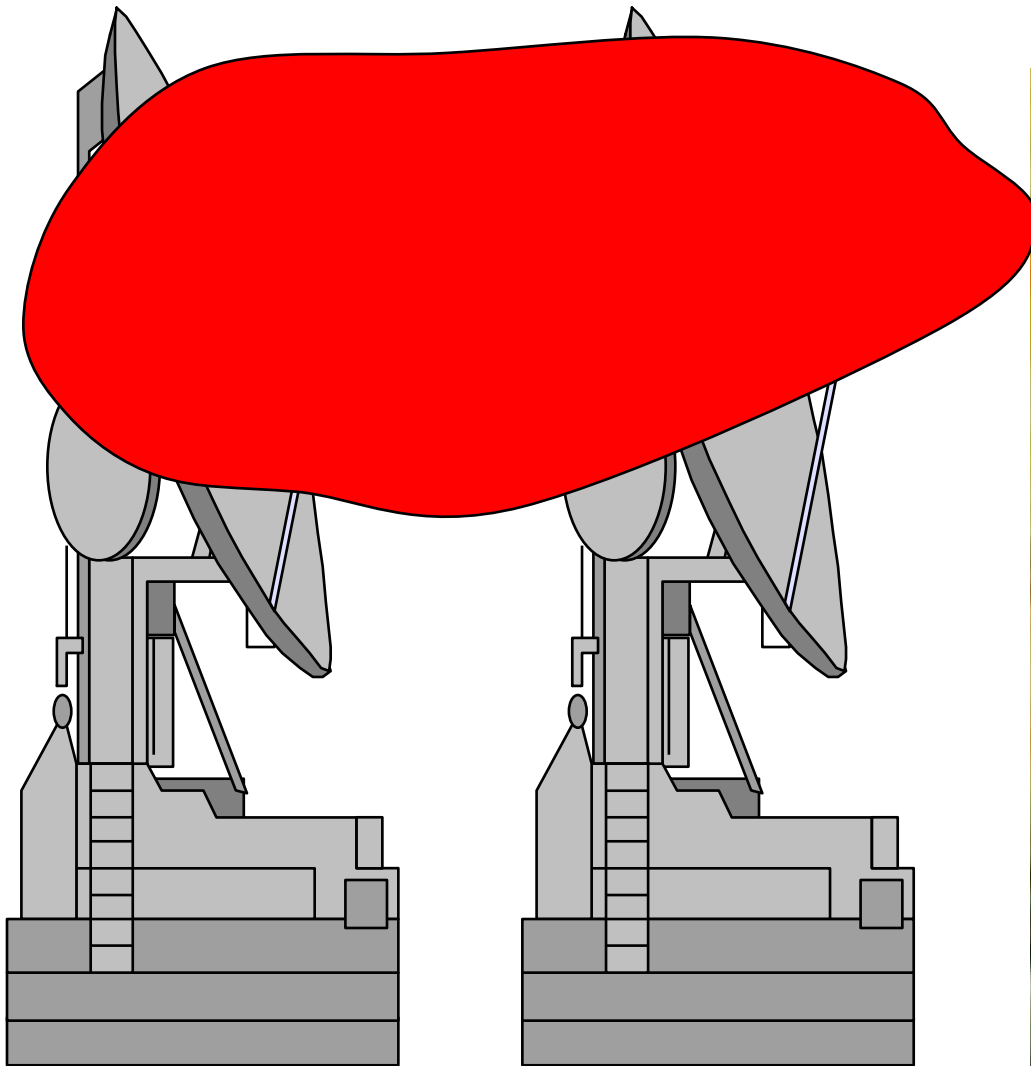
# Reliable operation with 2 satellites and 4 GESs



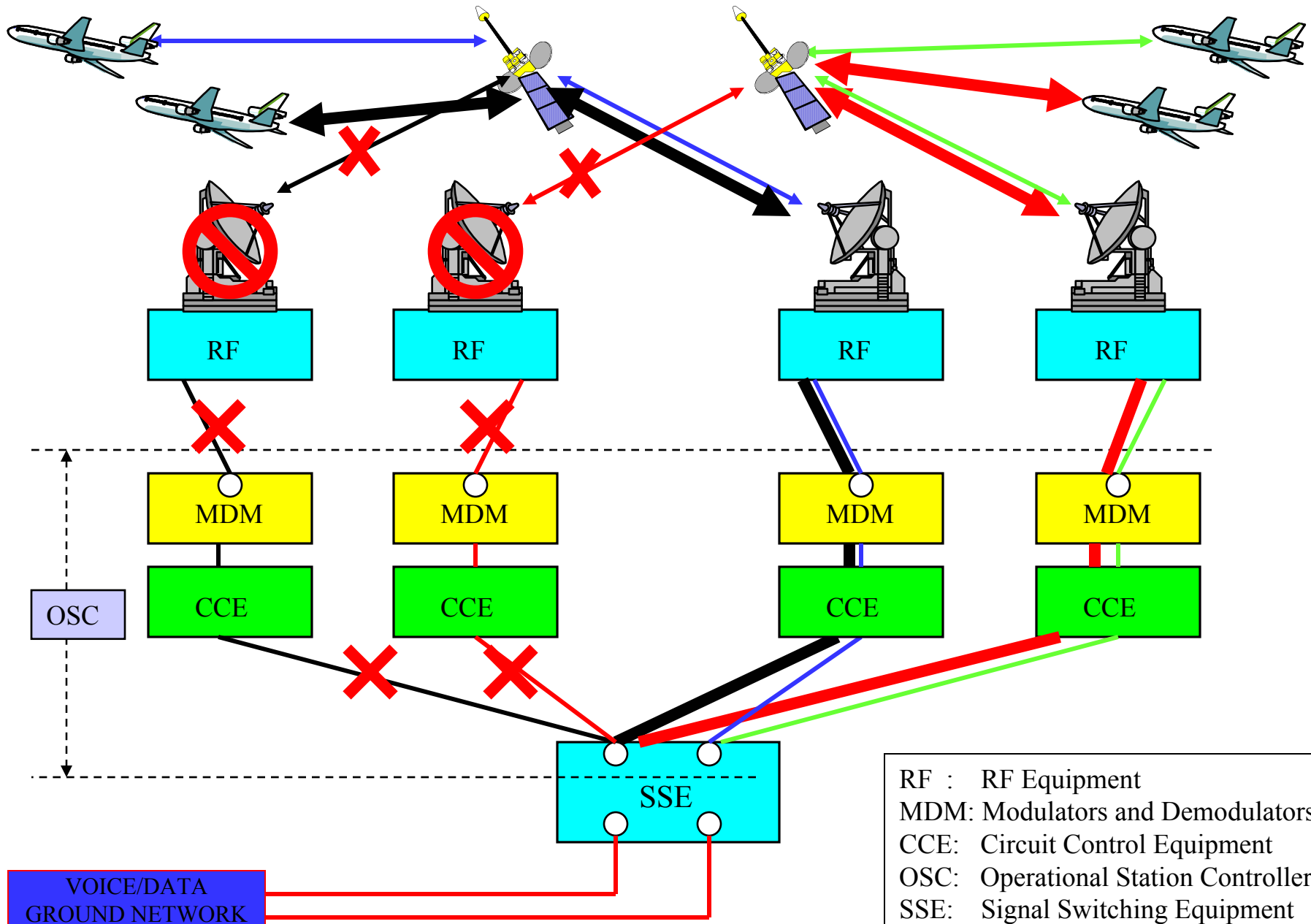


# In the case of satellite failure



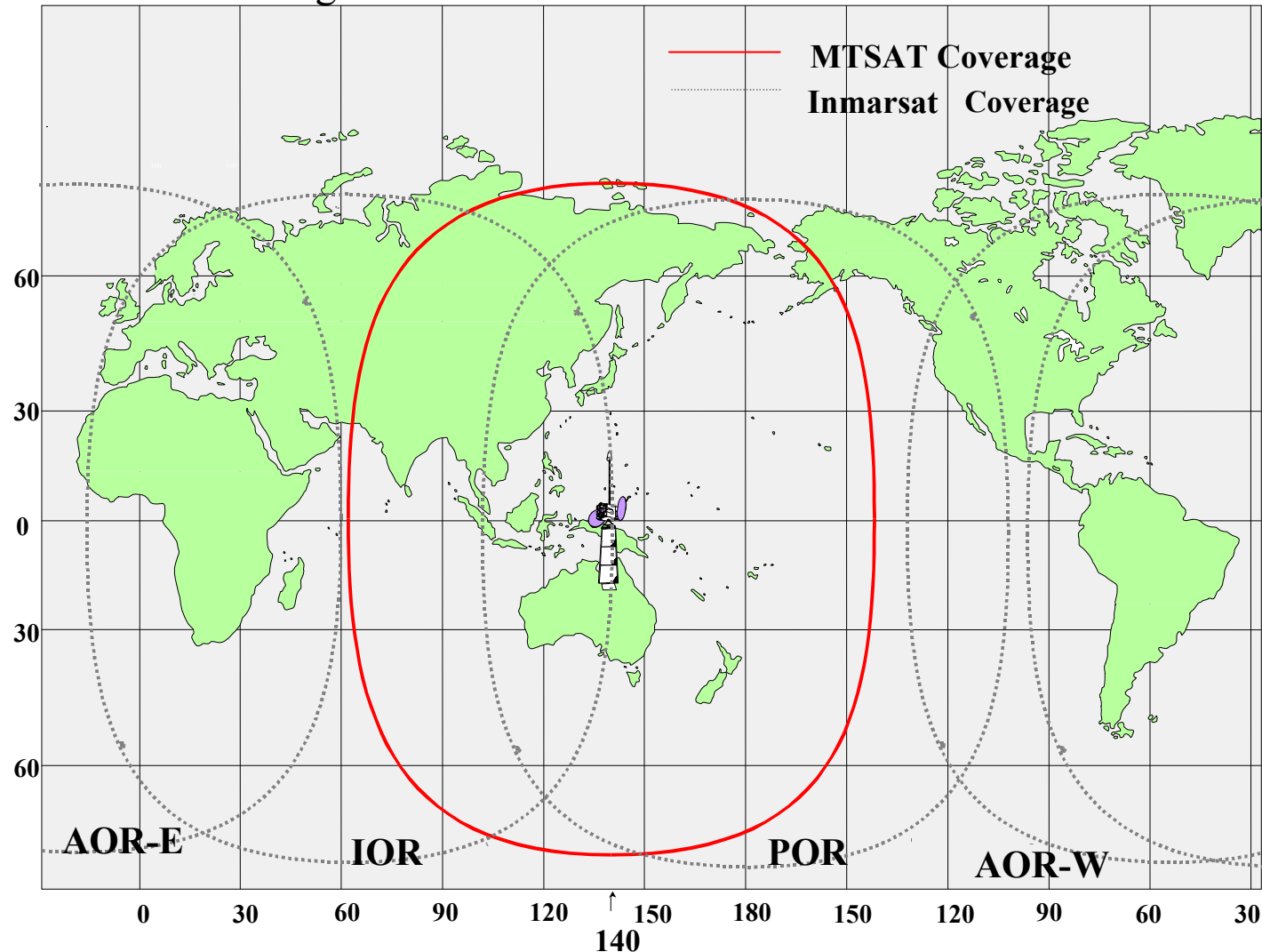


# In the case of GESs failure

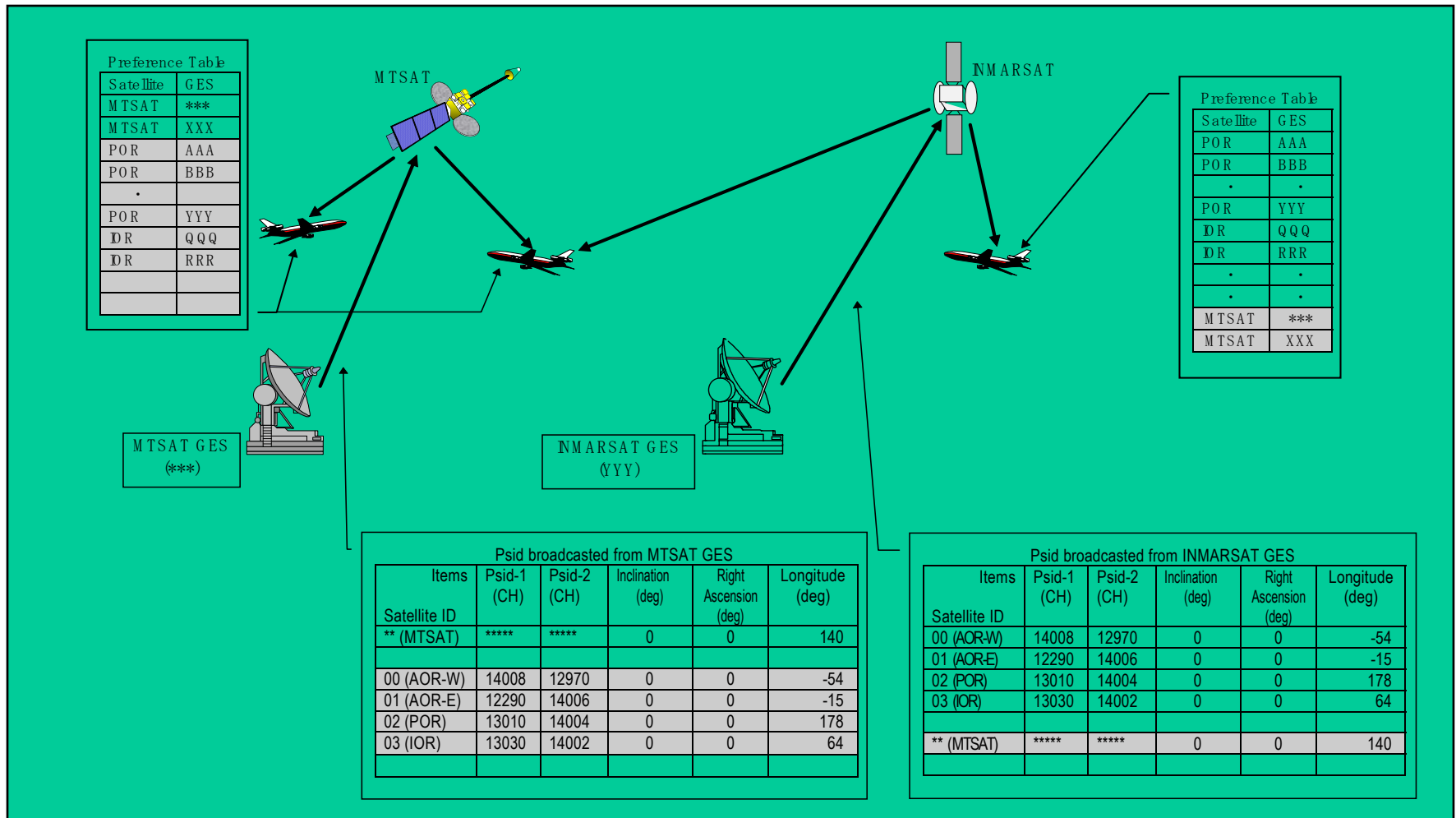


# Interoperability with existing AMSS

Coverage of MTSAT and Inmarsat Satellites



# Maintaining Interoperability



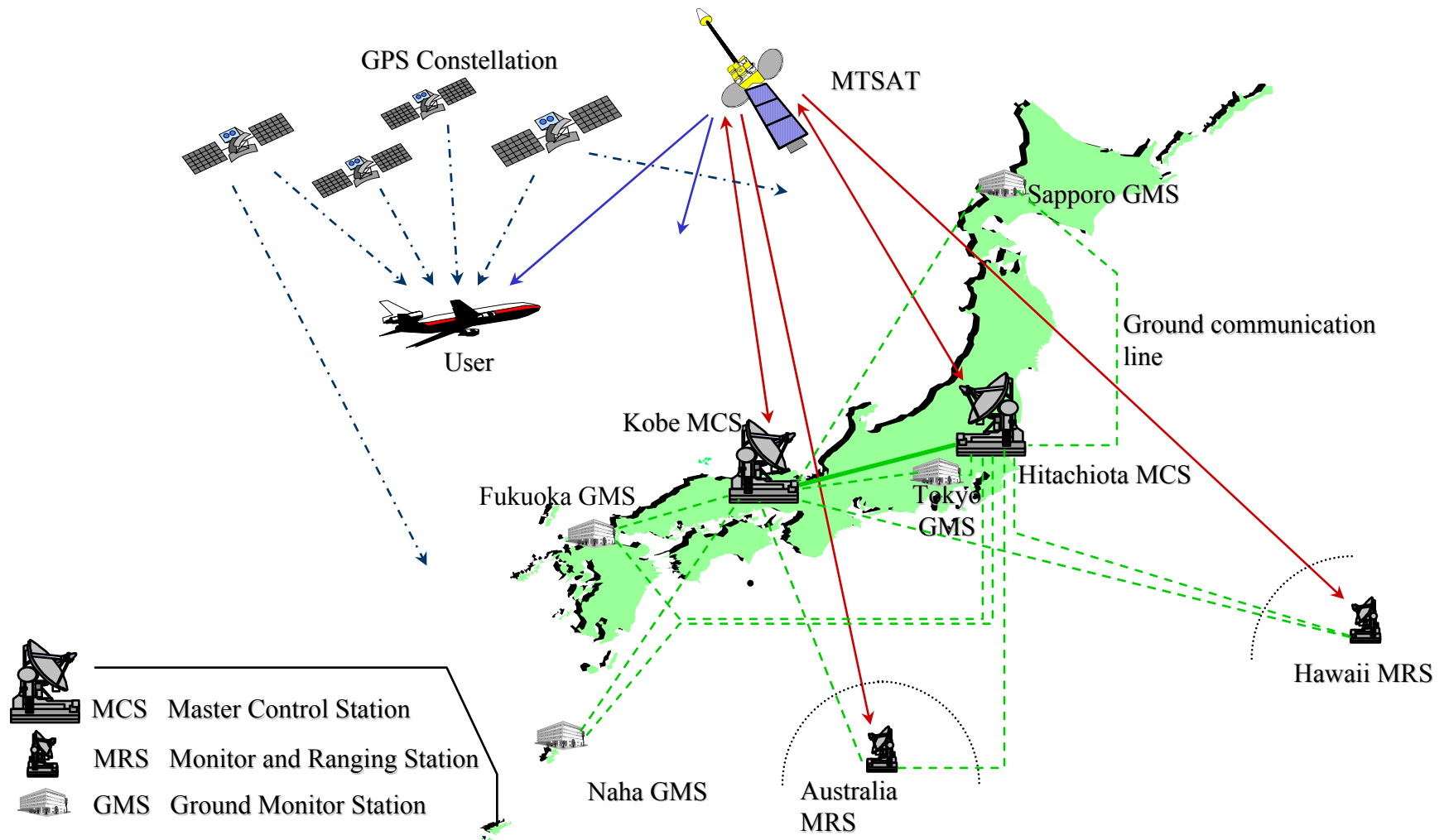
# Maintaining Interoperability

- Both Inmarsat and MTSAT GES will transmit a Common System Table to enable AES to have Inmarsat and MTSAT while including GESs on its owners requirement table for interoperability between the systems.
- This mechanism has been coordinated in the ICAO AMCP, and maintained under an MOU between JCAB and Inmarsat in the scope of the the ICAO SARPs.
- An Inmarsat commissioned AES will log on to Inmarsat or MTSAT automatically under the coverage, provided adequate preference is given in ORT.

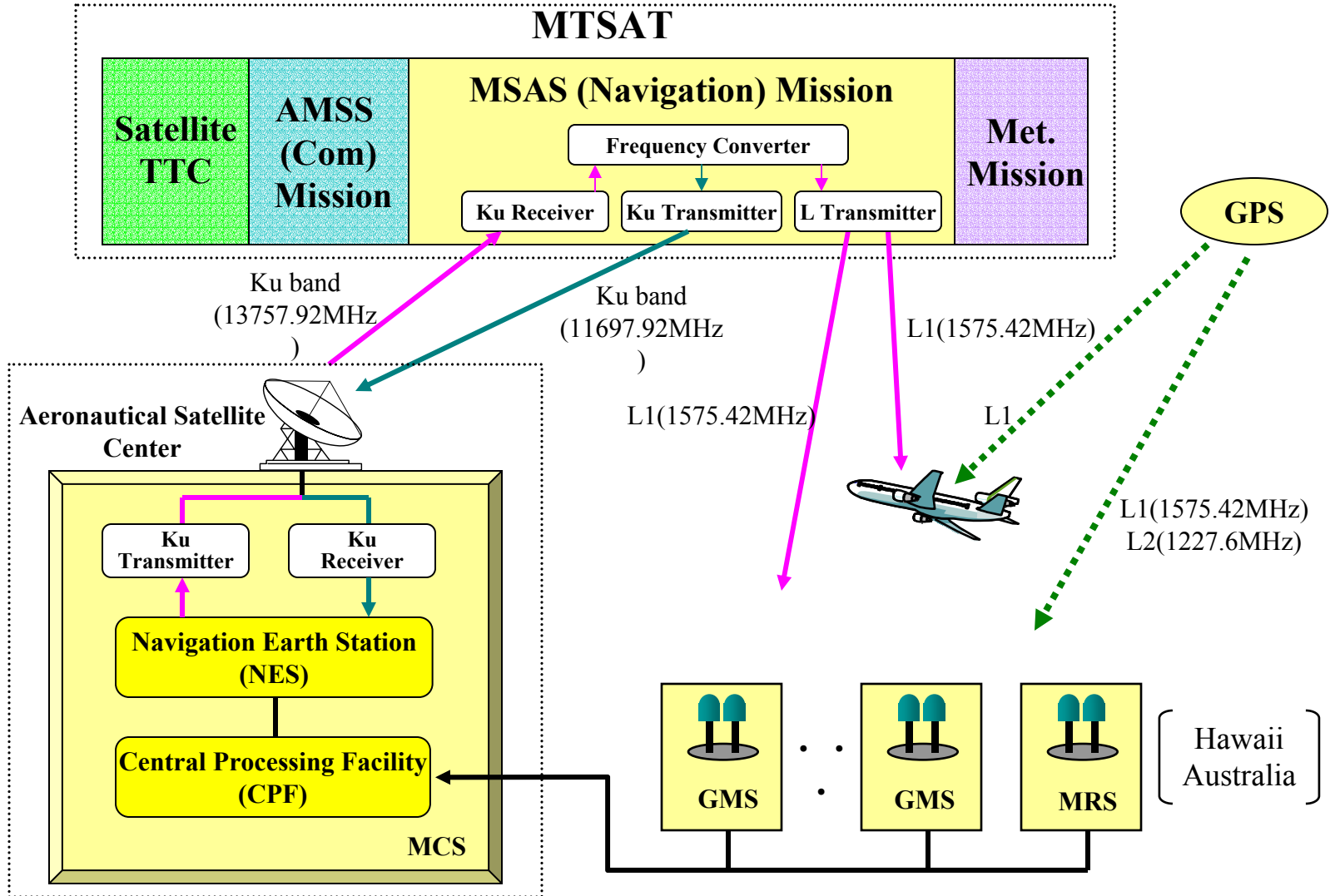
# MSAS Overview

- MSAS (MTSAT Satellite-based Augmentation System) is one of three SBASs compliant with ICAO SARPs.
- Dual GEO (two MTSATs) coverage will ensure high reliability and availability of services
- MSAS is expected to function as a shared infrastructure within the Asia/Pacific region for GNSS.

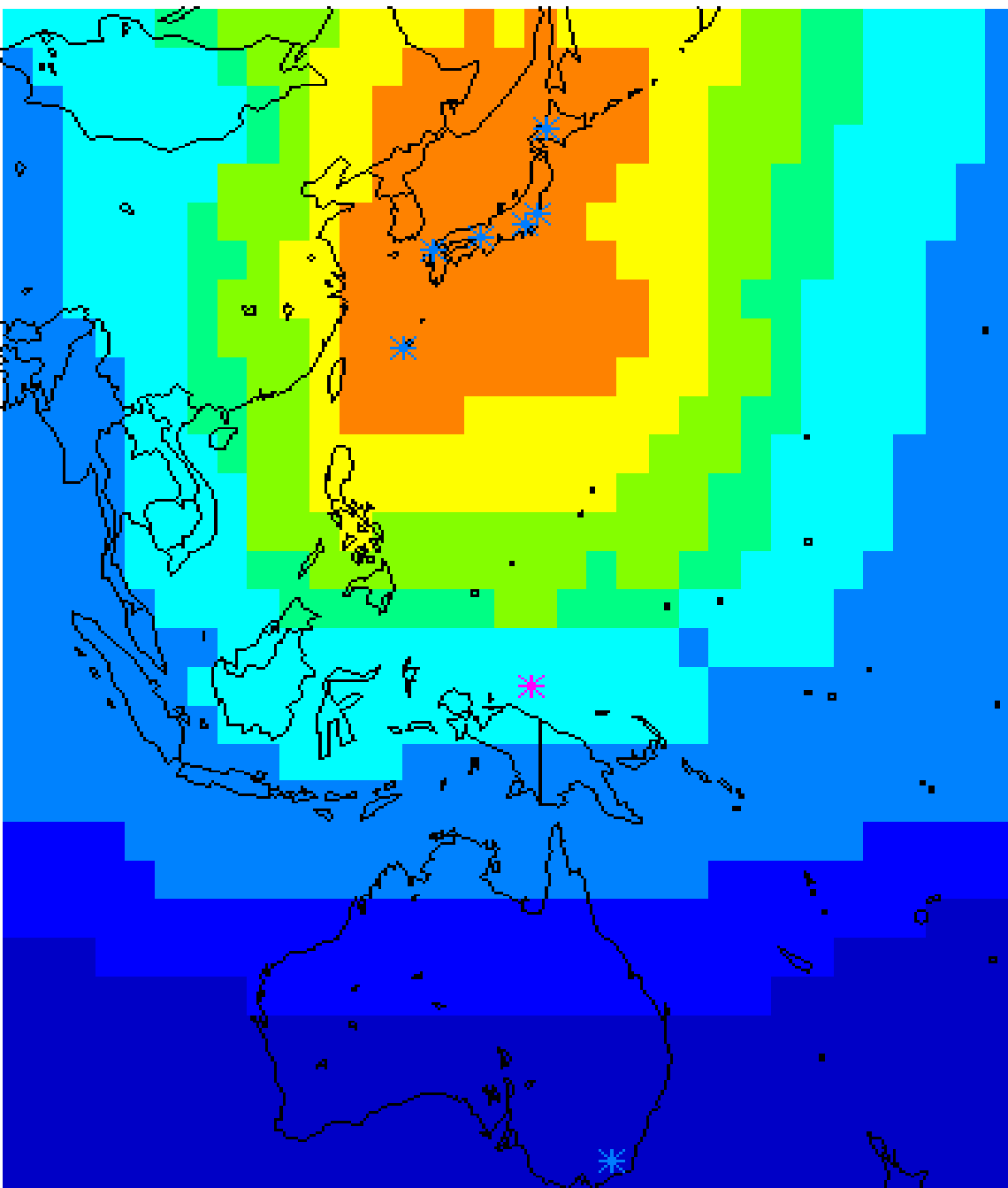
# System Configuration - MSAS













# MSAS Configuration



# Service Volume Model Analysis (NPA) MSAS 8 site



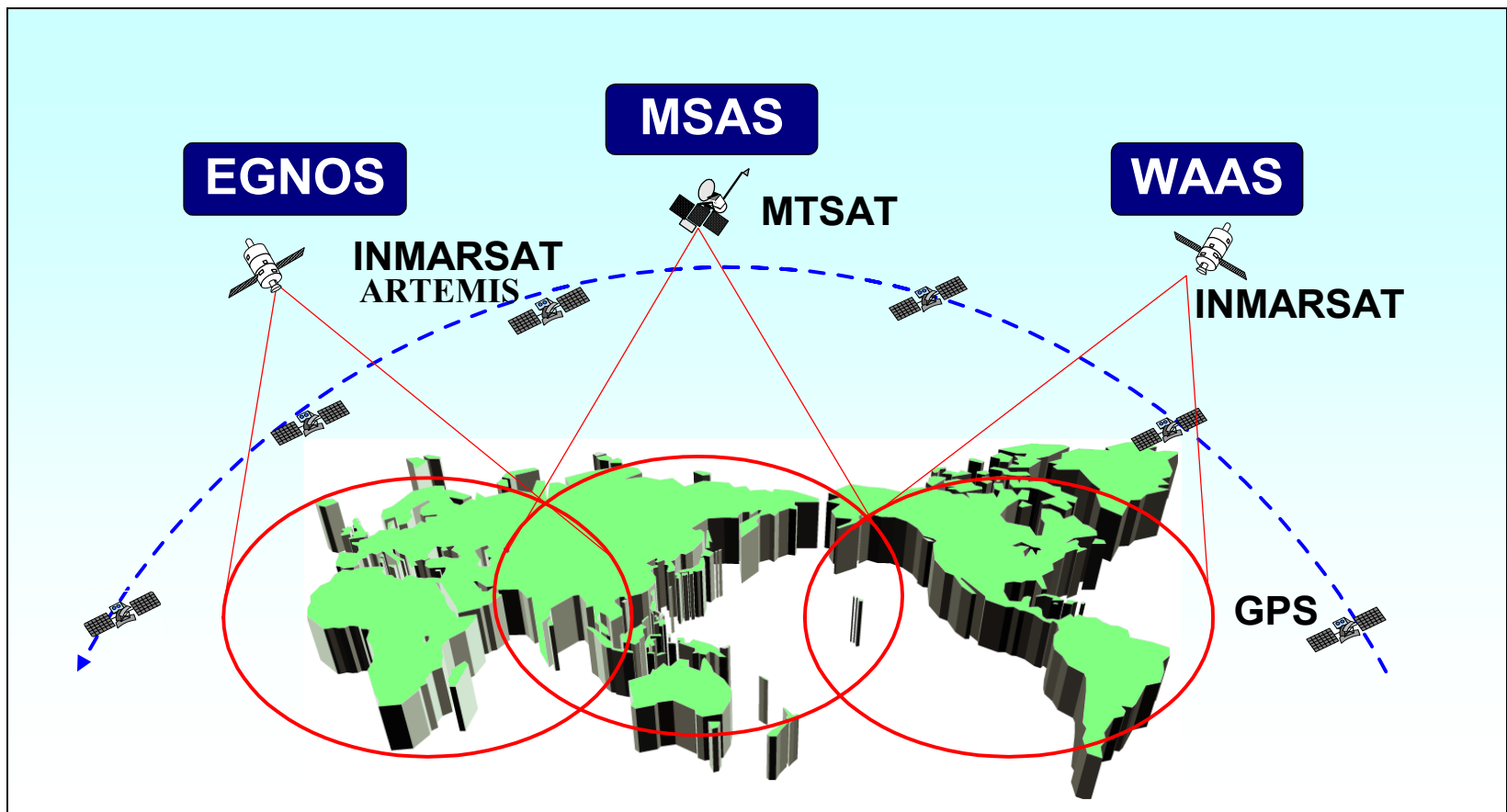
## Legend

	99.9990%~100.0000%
	99.9900%~99.9990%
	99.9500%~99.9900%
	99.9000%~99.9500%
	99.8000%~99.9000%
	99.7000%~99.8000%
	99.0000%~99.7000%
	90.0000%~99.0000%
	70.0000%~90.0000%
	0.0000%~70.0000%

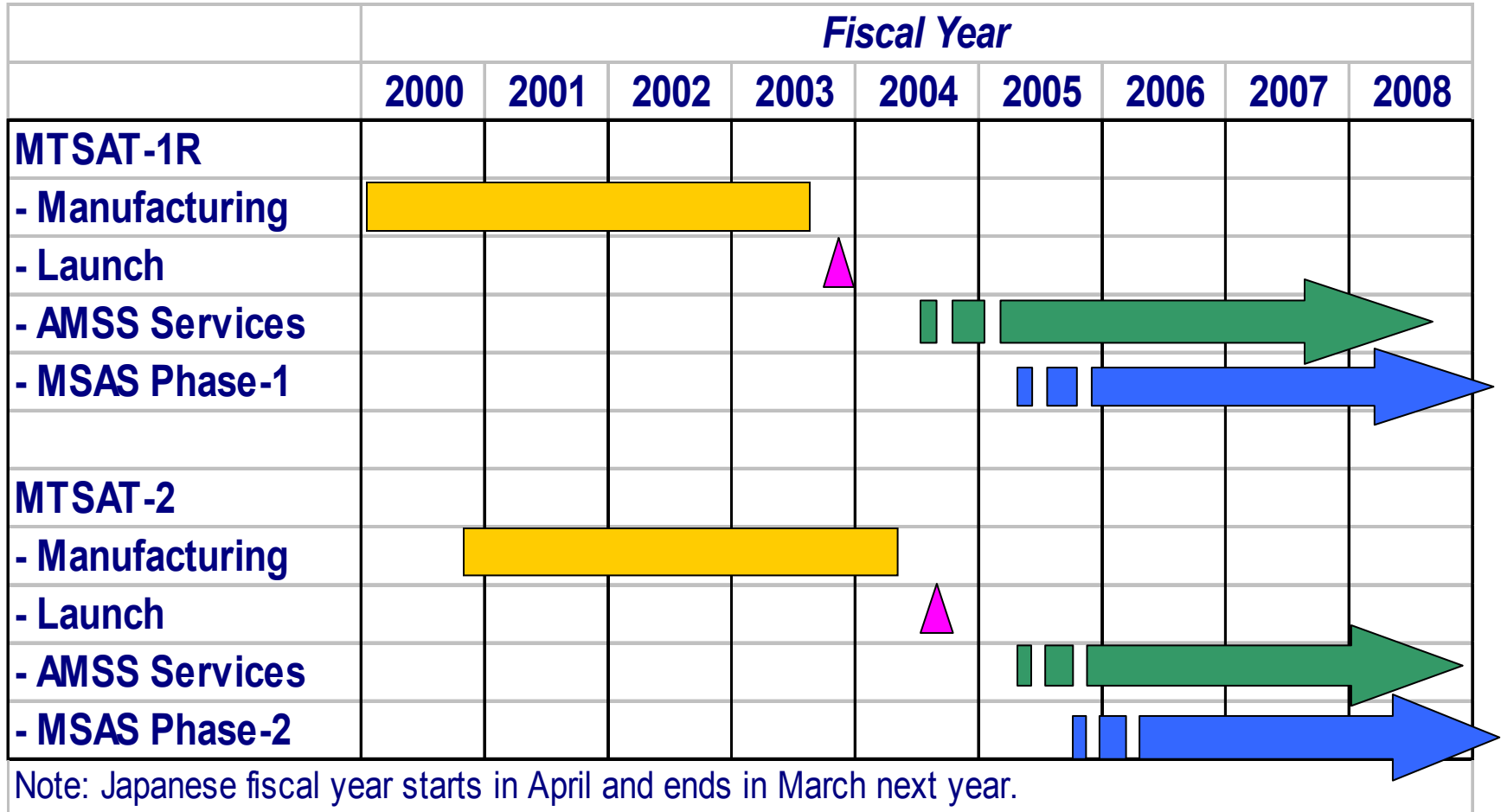
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# Interoperability among SBASs

MSAS is interoperable with U.S. WAAS and European EGNOS



# MTSAT/AMSS/MSAS Schedule





Thanks

